

Contextualising urban resilience in Ghana: Local perspectives and experiences



Rhoda Mensah Darkwah^a, Patrick Brandful Cobbinah^{a,b,*}, Prince Aboagye Anokye^a

^a Department of Planning, College of Art and Built Environment, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana

^b Institute for Land Water and Society, Charles Sturt University, P.O. Box 789, 2640 Albury, New South Wales, Australia

ARTICLE INFO

Keywords:

Urban resilience
Climate change
Urban growth
Urban planning
Kumasi
Urban development

ABSTRACT

Climate change and unplanned urban growth remain two emerging environmental and health threats with widespread implications for poor countries. Yet, despite attempts by governments and international organisations at addressing these challenges, they remain unabated. Understanding the challenges through a resilience lens can support actions for addressing these impacts. Regardless of this potential, the application of urban resilience to sustainable urban environments remains a distant reality in areas most vulnerable to the impacts of these environmental and health threats. Understanding of the application of the resilience concept to urban development and its outcomes are limited in Ghana. This study fills this gap by focusing on: the extent of climate change in the city of Kumasi; local experiences of major unplanned urban growth challenges in Kumasi; local understanding of urban resilience; and efforts towards urban resilience. Using institutional interviews and household surveys, findings indicate a rising trend of temperature and unpredictable rainfall pattern in Kumasi. This situation is generating negative consequences such as flooding, destruction of ecologically sensitive areas, and related diseases such as malaria. Complicating matters further are the impacts of unplanned urban growth, including poor sanitation conditions, inadequate social services, and poor housing conditions. Unfortunately, despite these challenges, there is limited understanding of urban resilience in Kumasi, amongst both urban planning related institutions and local communities. As a consequence, institutional initiatives towards urban resilience are uncoordinated and incomprehensive.

1. Introduction

Emerging environmental and health threats, particularly climate change and unplanned urban growth, are increasingly risking the future of African cities (Intergovernmental Panel on Climate Change [IPCC], 2013). Whilst for some (Cobbinah & Anane, 2016; IPCC, 2013), ongoing and future impacts of climate change are predicted to make human survival and natural systems uncertain and difficult with African countries being the most vulnerable due to their reliance on climate-dependent sectors (e.g., hydro-electricity, rain-fed agriculture), others (Cobbinah et al., 2015; United Nations Department of Economic and Social Affairs/Population Division [UNDESA/PD], 2012) have identified unplanned urban growth as a socio-economic threat in Africa. For example, studies (e.g., Stockholm Environment Institute [SEI], 2008; United Nations [UN], 2008) suggest that climate change is already impacting on the socio-economic functionality and human survival in Africa. SEI (2008) reports widespread changing weather patterns in Africa which have resulted in stresses such as increased competition over resources and destruction of biodiversity.

Alternatively, urban growth in Africa, according to Cobbinah et al. (2015), is estimated to reach about 58% in 2050, which implies that Africa would be home to nearly quarter (1.3 billion) of the global urban population. It is, however, worth noting that this growth is not uniform across African countries or cities. In fact, the widely held notion of the African continent being characterised by rapid urban growth is hotly contested (Obeng-Odoom, 2010; Potts, 2009, 2012). Potts (2009) strongly argues that the rapid urban growth mantra is based on unreliable population data and that urban growth rates in many African countries have actually slowed with most recent census data indicating that growth rates in many cities are no higher than or even below national rates. Regardless of crevices that exist at the country level, Potts (2009) asserts that demographic process of urban growth and the re-location of population from rural to urban areas are gradually stagnating in a number of African countries. In fact, there are cases of counter urban growth (e.g. Zambia, Côte d'Ivoire and Mali), and weak in-migration towards cities (e.g. Benin and Mozambique) (Owusu & Oteng-Ababio, 2015; Potts, 2009). Yet, some cities in African countries (e.g., Tanzania, Kenya and Niger) continue to record high urban growth

* Corresponding author at: Department of Planning, College of Art and Built Environment, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana.
E-mail address: pcobbinah@csu.edu.au (P.B. Cobbinah).

(see Owusu & Oteng-Ababio, 2015; Potts, 2009).

Efforts to address and adapt to these environmental and health challenges have become urgent, tenable, and ever pressing in recent years (IPCC, 2013; UNDESA/PD, 2012). The notion of resilience has emerged over the past four decades as a strategy, when applied, will contribute to supporting actions towards responding and adapting to these challenges (Beatley & Newman, 2013; Pickett et al., 2004; Urban Land Institute [ULI], 2010). Although its origin is strongly grounded in ecological discipline where it was used to describe the capacity of a system to survive and recover from adverse events, and ensure a bounce back into a stable equilibrium state (Liao, 2012; Serre & Barroca, 2013), the concept of resilience is presently applied across multiple disciplines, including urban studies.

Research evidence indicates that many developed country cities are marching towards resilience by adopting and applying the resilience notion in urban planning practices, including Istanbul (Turkey), Edinburgh (Scotland), Manchester (England), Sydney (Australia) (ULI, 2010), Tokyo (Japan), Singapore, Makati and Albay (Philippines) (Prasad et al., 2009). However, little is known about urban resilience in African cities (United Nations Office for Disaster and Risk Reduction, [UNISDR], 2013), despite the continent being one of the most vulnerable regions in terms of climate change and unplanned urban growth impacts (Cobbinah et al., 2015; IPCC, 2013).

In this sense, research into urban resilience in African cities is timely and necessary. This paper explores urban resilience in Africa, using Kumasi as a case study from Ghana. From the foregoing analysis, the study finds answers to the following questions: (i) What is the state and extent of climate change in Kumasi? (ii) What are the key unplanned urban growth challenges facing Kumasi? (iii) What does urban resilience concept mean to local agencies and communities in Kumasi? and (iv) How are local agencies supporting and promoting urban resilience in Kumasi?

2. Urban resilience in Africa: conceptual framework

Urban planners and researchers have had a long-standing engagement with trying to understand the interplay of environmental, socio-cultural, economic and political processes that shape urban vulnerability – i.e. “the state of susceptibility to harm from exposure to stresses associated with environmental and social change, and from the absence of capacity to adapt” (Adger, 2006, p. 268) – to climate change and urban growth (e.g., Blakely, 2007; Bulkeley et al., 2009; Ogato et al., 2017). A key approach in this regard is urban resilience – broadly understood as the capability and preparedness of cities to withstand and respond to severe shock, and make necessary adjustments for continuing functioning while their inhabitants strive irrespective of the severity of the shock (Ove Arup & Partners International Limited [OAPIL], 2014; ULI, 2010). Among other issues, urban resilience posits that any approach to urban development in these changing times must seriously confront questions linked to vulnerability of urban residents and communities to the upsurge in economic and environmental pressures and instabilities related to globalisation, rapid urban growth, climate change, poverty and resource depletion (e.g., Prasad et al., 2009; Seeliger & Turok, 2013). Much of the work rooted in this approach has critically contributed to shaping how urban environmental problems are appreciated, solutions conceptualised, and intervening ideas advocated particularly in developed countries such as Australia, Canada, Sweden, Turkey, Portugal and the Netherlands (Planning Institute Australia, 2016; Schmitt, 2013; Walisser et al., 2005).

In this paper, the authors draw on the urban resilience concept to understand the preparedness of African cities to adapt to climate change and unplanned urban growth, and their associated impacts. Works on urban resilience in city-wide contexts range widely in terms of geographical settings and extent of vulnerability. For example, while the application of urban resilience in some United States cities, such as New Orleans, is in response to major natural disasters such as

hurricanes and tornados (Campanella, 2006), in the Netherlands cities (e.g., Rotterdam), it is applied in spatial planning in response to rising sea level and associated flood events (Lu & Stead, 2013). Although within the cities of developing countries in Africa, urban resilience has not fully been integrated and applied in planning efforts, research (e.g., Cobbinah & Darkwah, 2016a) indicates that the concept is relevant to planning practice, and that its application can lead to a restoration of depleted urban greenery. To varying degrees, the aforementioned studies conceive urban resilience as a new urban planning agenda that, when applied, has the potential to aid cities and residents to withstand shocks associated with major global environmental and health issues relating to climate change, urban growth and poverty (UNISDR, 2013). This is also consistent with the UN Sustainable Development Goals particularly goal 11 on sustainable cities and human settlements (UN, 2016). This goal, according to Cobbinah (2017), encourages national governments to pursue economically and socially sound, as well as environmentally friendly interventions (e.g. through urban policy) for making cities inclusive, safe, resilient and sustainable. In this regard, the UNISDR (2013) identifies nine key tenets of how urban planning can contribute to urban resilience especially in Africa:

1. Working with multiple stakeholders throughout the planning process to identify known risks, needs and potential solutions, realising the potential of communities to contribute to risk reduction.
2. Incorporating risk assessment – considering exposure, vulnerability and hazards, urban settlements development and services – in all urban development designs, projects and programmes.
3. Making safe land available for urban development, avoiding construction in disaster prone areas, leaving buffers and providing recreational areas.
4. Ensuring that public space for streets, infrastructure and parks is identified and protected.
5. Upgrading informal settlements, with attention to access roads, flood-risk, and other safety measures.
6. Installing risk-reducing infrastructure, including drainage and sewerage systems.
7. Assessing how urban development contributes to improving the lives of the poorest or most vulnerable people in a city.
8. Developing good information on risk and communicating risk information widely.
9. Protecting ecosystems to allow proper storm water drainage, avoid extensive erosion, and protect against storms and tidal waves.

For the purpose of this article, three core issues within the African context make urban resilience relevant. The first relates to evidence of climate change and its associated actual and potential impacts on the functionality of African cities. Scholarly opinion (e.g., Amos-Abanyie, 2011; Mosha, 2011) suggests that Africa's climate has been altered considerably over the past half a century in terms of average weather patterns. The tragedy of extreme weather events (e.g., flood, droughts, and warming temperatures) continues to cause extraordinary human suffering (e.g., increased poverty) in Africa (Cobbinah & Anane, 2016; IPCC, 2007). As a result, there is a growing concern regarding how to deal with the repercussions of climate change in Africa where majority of urban populations are vulnerable to climate-related disturbances (Tyler & Moench, 2012; UN-Habitat, 2011). The United Nations Environment Programme [UNEP] and United Nations Development Programme [UNDP] (2010) believe that unless strategies are cautiously and methodically introduced to achieve resilience and alleviate susceptibility, climate change may threaten African countries efforts towards realising the sustainable development goals. Similarly, Tyler and Moench (2012, p. 312) encourage “practitioners to consider innovation and changes to aid recovery from stresses and shocks that may or may not be predictable”. Consequently, this article seeks to examine evidence of climate change in Africa using Ghana as a case study, and the preparedness of Ghanaian cities in dealing with climate change. Here,

this article draws specifically on the urban resilience concept to understand local perspectives, experiences and actions towards climate resilience.

A second related issue is unplanned urban growth. In Africa, human populations are mostly concentrated in cities with inadequate housing and living space, clean water, and solid waste management systems (UNDESA/PD, 2012; UN-Habitat, 2014). This situation frequently results in unsustainable land development in the form of urban sprawl (massive and uncontrolled physical development) and emergence of informal settlements (slums), and water and sanitation challenges. In Ghana, for example, unplanned urban growth is variously described as a major cause of loss of urban biodiversity, air and water pollution, environmental decay, and overcrowded living (Amoako & Cobbinah, 2011; Awumbila et al., 2014). Regrettably, Cobbinah et al. (2015) note that there is limited meaningful guidance available to city authorities on appropriate approaches in addressing the unplanned urban growth concerns in African cities. In their reflections, Cobbinah et al. (2015) advocate strong policy direction, institutional empowerment and capacity building, and expansion of the role and engagement of urban residents in the planning process as critical issues worth considering in addressing unplanned urban growth. Underlying these recommendations is the concept of urban resilience. Within this context, urban resilience offers space to consider planning interventions that transcends mere urban survival to include comprehensive efforts that reflect local conditions and aspirations in relation to achieving a balance between urban living, environmental conservation, and economic development (Jabareen, 2013). This article pursues a similar kind of analysis here to explore how various planning agencies and vulnerable communities work cooperatively towards resilience in Ghanaian cities. The article examines the categories of urban growth that were consciously expressed in the interview transcripts and observed during the fieldwork, and compared them with the nine tenets provided by the UNISDR (2013).

Third, the application of urban resilience in developing countries should be sensitive to local socio-economic context (Chelleri & Olazabal, 2012). While the analytical focus of this article is mostly on climate change and unplanned urban growth, it is acknowledged that local socio-economic conditions influence the extent of vulnerability of communities. As Cobbinah et al. (2015) picturesquely describe elsewhere, socio-economic challenges expressed in the form of unemployment, insecurity and vulnerability, and inadequate access to basic services are gradually chipping away the resilience of African cities. Thus in this article, the authors pay attention to the broader influence of socio-economic characteristics of urban residents that hinder or support urban resilience.

3. Case study area and research methods

3.1. Urban resilience in the Ghanaian urban planning context

Upon the introduction of formal urban planning in Ghana in 1877 by the British, town councils were established as a strategy to deal with poor sanitation and hygiene conditions that engulfed Ghanaian cities particularly Accra (Quarcoo, 1993). The responsibilities of the town councils, among others, were to make crowded neighborhoods decongested, ensure safety by removing unsafe and insanitary structures, and improve communication efficiency through improved roads, telegraph and postal communications (Gocking, 2005). In 1945, the Town and Country Planning Ordinance (Cap 84) was passed, and the Town and Country Planning Department (TCPD) established. This period marked the beginning of efforts towards national urban planning (Fuseini & Kemp, 2015). The Cap 84 mandated the TCPD to plan and manage the growth and development of urban and rural settlements in Ghana. For Cobbinah and Korah (2016), the introduction of the Cap 84 and the establishment of the TCPD had the fundamental purpose of promoting sustainable development of Ghanaian settlements

epitomised by efficiency, orderliness, safety and health.

Regrettably, as Cobbinah and Korah (2016) argue, the role of the Cap 84 and the TCPD in dealing with urban planning and management challenges between the 1950s and 1980s was impeded as Ghanaian government failed to make any considerable efforts towards decentralising urban planning following independence in 1957. Scholarly opinion (e.g., Adarkwa, 2012; Boamah et al., 2012) suggests that urban planning during the period was centralised, nationally oriented and was not people-centered as it was insensitive to community aspirations. A decentralised approach to planning was introduced in 1988 to provide a community-centered approach to planning through the creation of Metropolitan, Municipal and District Assemblies (MMDAs). The passage of Local Government Act of 1993 (Act 462), as part of the evolving governance system, provided a legal framework to support the implementation of the decentralised approach to planning. According to Fuseini and Kemp (2015), several other legislation were enacted during the 1990s to support urban planning practices, including the National Development Planning Systems Act of 1994 (Act 480) and the National Building Regulation Act (LI 1630). Even in the 21st century, a number of planning legislation and policies have been passed, including the Land Use and Spatial Planning Act 2016 (Act 925) and the National Urban Policy Framework 2012.

Regardless of these planning laws and administrative setup, urban planning in Ghanaian cities has become a product of inadequacies in the planning systems (e.g., under-resourced urban planning institutions), distortions in land management practices (e.g., the challenges of land tenure systems), contradictions of roles (e.g., traditional authorities assuming the role of urban planning institutions) and conflicts in public knowledge on planning issues (e.g., limited public knowledge on urban planning in Ghana) that continue to increase vulnerability of Ghanaian cities (Adarkwa, 2012; Cobbinah, 2017; Fuseini & Kemp, 2015). In such situations, it becomes clear that urban planning that builds resilient cities is lacking in Ghana as cities have become locations for accumulated stresses (e.g., housing challenges) and unexpected shocks (e.g., floods) that often result in social breakdown, physical collapse and economic deficiency (Cobbinah & Darkwah, 2016b; Quagraine, 2011).

3.2. Study setting

This research focused on Kumasi. Kumasi has a total land area of 214.3 km² (Ghana Statistical Service [GSS], 2014), and is situated in the wet equatorial climatic zone of Ghana, about 270 km north-west of Accra, the national capital of Ghana (see Fig. 1). With an annual growth rate of 5.7% between 2000 and 2010 (Owusu-Ansah, 2015), Kumasi is fast urbanising spreading into neighbouring districts (see Cobbinah & Aboagye, 2017; Cobbinah & Aboagye, 2017). The outcome of this rapid urban growth and outward expansion of Kumasi has mostly been negative, such as the destruction and pollution of water bodies, alteration of the natural environment, conversion of agriculture lands into residential and related uses, increased pressure on social services, and high consumption of energy. For example, several reserved green belts in Kumasi such as the Atonsu, Subin and Kaase nature reserves have been altered with colonial parks like the Abbey's and Jackson being encroached upon by residential and commercial buildings (Quagraine, 2011). Per the rate of depletion of Kumasi's urban landscape, Quagraine (2011) claims it has resulted in rising temperatures and higher air pollution concentration levels in the city.

Similarly, Owusu-Ansah (2015) reports of damaging flood events in Kumasi which are caused by, among others, impervious surface and human occupation in unauthorised locations such as areas liable to flooding. Previous studies (Adarkwa, 2012; Quagraine, 2011) have suggested a variety of ways to deal with the negative implications of unplanned urban growth and climate change impacts in Kumasi: adequate provision for various land uses and facilities such as residential, commercial, industrial and circulatory, landscaped areas, prime

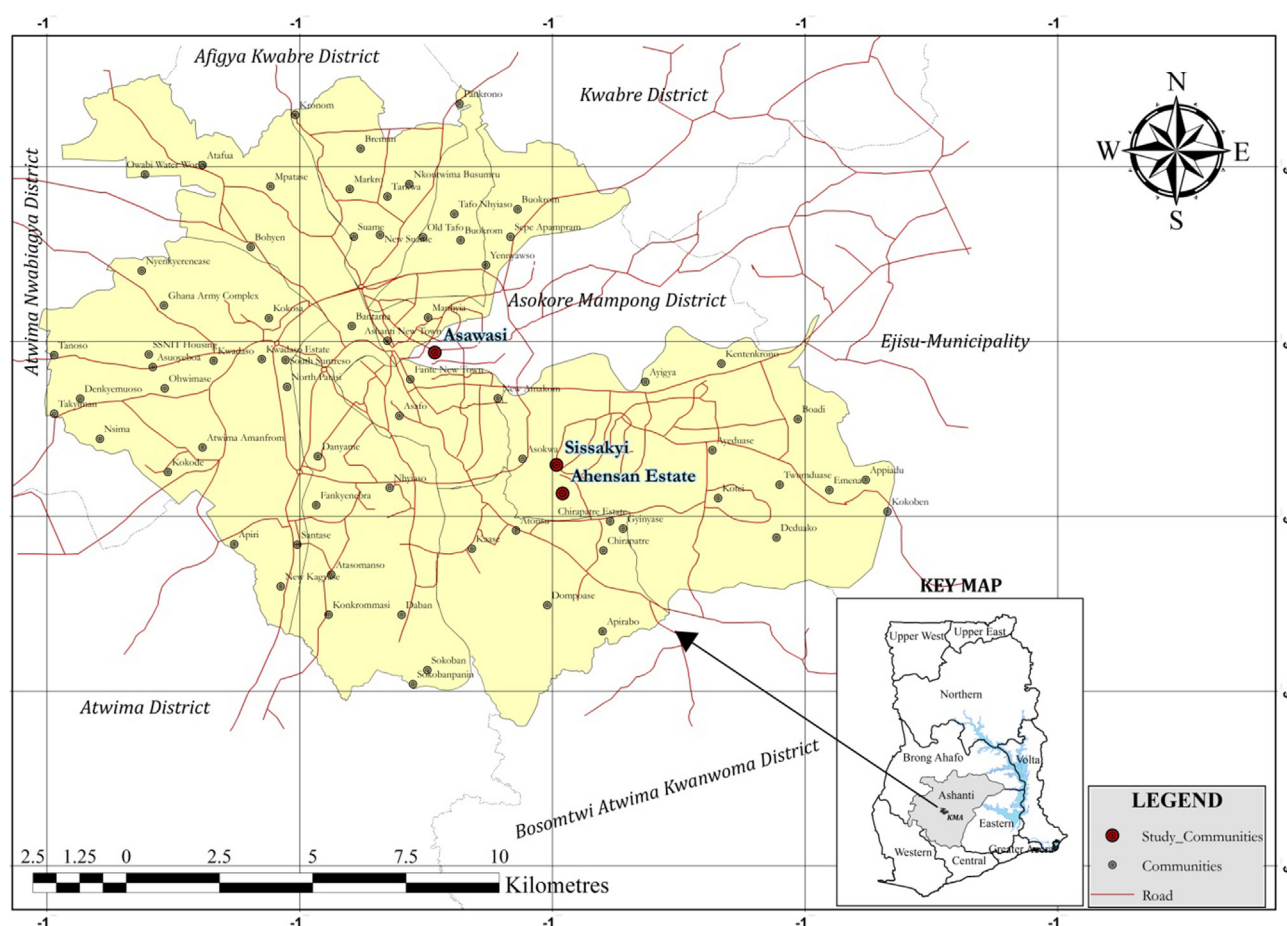


Fig. 1. The case study communities in the context of Kumasi.

Table 1

Sample size determination.

Source: Estimates based on average persons per house and total population (2010 data).

Case study communities	Criteria for selection	Sampling frame (Houses) (N)	Sample size (n)
Sisaakyi	Flood vulnerable area	387	111
Ahinsan Estate	First class residential area	486	118
Asawase	Evidence of slum conditions	2525	147
Total		3398	375

agricultural lands, wetlands and forest reserves. Underlying these proposals are the tenets of urban resilience. Yet, urban planning in Kumasi and most Ghanaian cities has largely been one of a knee-jerk and reactionary approach to disasters and emergencies (see Cobbinah & Darkwah, 2016b). Evidence of failure of city authorities to plan, develop and manage the development of Kumasi abounds (e.g., Cobbinah & Amoako, 2012; Owusu-Ansah, 2015).

3.3. Research methods

This paper is based on a study carried out in 2015–2016 on urban resilience and planning in Kumasi. Household survey (comprising both open and close ended questions) and institutional interviews were used. At the community level, the multi-stage sampling approach was used to determine the household respondents to be involved in the household survey. First, purposive sampling was used to select one district

(Asokore Mampong Municipality) and one sub-metro (Oforikrom sub-metro) in the Kumasi Metropolitan Area, all in the city of Kumasi. Two communities: Sisaakyi and Ahinsan Estate, were selected from the selected sub-metro and one community (Asawase) was selected from the Asokore Mampong Municipality for the study (see Fig. 1). Although the city of Kumasi has over 20 communities/suburbs, only communities experiencing unplanned urban growth challenges, and at a high risk of climate change impacts were considered for this study. The study used the Slovin's Formula to determine the sample size: $n = N / 1 + Ne^2$, where n = sample size, N = sampling frame and e = margin of error. The sampling frame (N) represents the estimated total number of houses in each of the three communities. Houses were used as the sampling frame instead of households because of a lack of reliable data on the number of households in the study communities. With a margin of error of 0.05, the sample size (n) was determined from the sampling frame (N) as shown in Table 1.

Second, simple random sampling was used to select the houses to be involved in this study. This sampling method ensured that all houses had equal chances of being selected. The final phase of the multi-stage sampling involved random purposive sampling. Following the identification of the houses to be involved in this study, this sampling method was used to select household respondents from each of the three communities targeting older household members (18 years and above).

Institutional interviews were undertaken using semi-structured interviews with five relevant local government and planning institutions: TCPD responsible for land use planning of the city; Environmental Protection Agency (EPA) in charge of environmental issues in Kumasi; National Disaster Management Organisation (NADMO) mandated to deal with disaster events through education and logistical support; Department of Urban Roads (DUR) in charge of roads in the city, and

Table 2
Basic characteristics of sampled community respondents (n = 375).
Source: Field Survey January–February 2016.

Variable	Proportion of respondents (%)			
	Asawase	Ahinsan Estate	Sisaakyie	Overall
<i>Household size</i>				
1–2	13	41	14	22
3–5	34	32	17	28
Over 5	53	27	69	50
Total	100	100	100	100
<i>Employment sector</i>				
Commerce	61	19	84	55
Industry	11	9	0	7
Service	28	70	13	36
Agriculture	0	2	3	2
Total	100	100	100	100
<i>Educational characteristics</i>				
Never	19	2	10	10
Primary	15	5	6	9
Junior High School	31	10	3	14
Senior High/Technical School	23	44	52	40
Tertiary	12	39	29	27
Total	100	100	100	100

Kumasi Metropolitan Assembly (KMA) responsible for the socio-economic and physical development of the city. The semi-structured interviews lasted between 60 and 120 min depending on the interest, experience and availability of the institutional representatives.

Quantitative and qualitative methods were used in analysing the data. Statistical Package for Social Sciences (SPSS) was used to facilitate the quantitative analysis while the qualitative analysis focused on description and explanations of the study variables (climate change, urban growth, and urban resilience) with the aid of NVIVO 10 software. The SPSS facilitated the analysis process by generating descriptive statistics such as percentages and frequency counts as well as establishing relationships between study variables, while themes, codes and categories were developed using the NVIVO 10 software.

4. Results and discussion

4.1. Characteristics of respondents

As presented in Table 2, over 50% of respondents have a household size of more than five, which is higher than the city and national averages of 3.8 and 4.4 persons per household respectively. In terms of educational background, findings indicate that majority of respondents in Asawase and Sisaakyi communities have had relatively low levels of formal education compared to Ahinsan Estate (see Table 2). About 10% of household respondents have never received any form of formal education, while 27% have received tertiary level education, mostly from Ahinsan Estate (39%). Findings on the occupation show that respondents were employed either in the formal sector (11%) or the informal sector (89%). The household survey results show that commerce (which includes petty trading, hawking, and self-owned businesses) remains the main employment sector for the households across the three communities.

4.2. Evidence and patterns of climate change in Kumasi

4.2.1. Increasing temperature

An analysis of temperature data over the last 40 years available from the Ghana Meteorological Department office in Kumasi revealed a gradual increase in both the average maximum and average minimum temperatures (see Figs. 2 and 3). Although the mean temperature shows an increasing trend, the climate data were highly variable. For example, the average mean maximum temperature ranges from 30.0 °C in 1975

to 32.1 °C in 2010. Similarly, year 1975 and 1998 had the lowest average minimum temperature of 21.0 °C and highest average minimum temperature (22.8 °C) respectively.

Between 1970 and 2013, the average maximum temperature of Kumasi increased by 1.3 °C. However, the highest change in the average maximum temperature of Kumasi occurred between 1975 and 2010 when a change of 2.1 °C was recorded. Similarly, the average minimum temperature increased from 21.8 °C in 1970 to 22.5 °C in 2013 representing a change of 0.7 °C. Yet, the highest change of 4.8 °C in the average minimum temperature was recorded between 1975 and 1998.

These statistical changes in temperature were further compared with impressions and opinions of residents in the study communities during the household survey questionnaire administration. Similar observations related to the increasing trend of warming, unpredictable rainfall and its impact on the survival of residents were reported by the communities, particularly Sisaakyi:

... The weather has become very hot in recent years, especially during harmattan (dry north easterly winds) season. We can't even sleep in our rooms during that period because the rooms become very hot [warm] ... Sisaakyi 7, February 2016.

As illustrated in Fig. 4, majority of respondents in Sisaakyi reported impacts in relation to perennial flooding and warming weather, compared to Ahinsan Estate and Asawase communities.

Discussions with the respondents, particularly those in Sisaakyi and Asawase where the perceived impacts of climate change seem severe (see Fig. 4), revealed that perennial flooding and increasing temperature resulting in warm weather have contributed to increasing attacks from mosquitoes as their communities have become favourable grounds for mosquito breeding:

... I can say that our community is one of the most infested mosquito neighbourhoods in Kumasi ... They are everywhere, even during day time ... Asawase 11, February 2016.

Although this situation is largely a result of poor sanitation conditions in these two communities, and may not necessarily be effects of climate change, the respondents blamed climate change as the cause of warming weather and perennial flooding in the study communities.

Consequently, an increasing trend of insanitary and water-borne diseases including malaria, cholera and dysentery was reported by the respondents:

... I go to the hospital almost every month because I get malaria from mosquito bite ... Sisaakyi 7, February 2016.

Although these are a result of human induced activities leading to environmental degradation, the communities maintained that changing climate in the form of flooding and warming weather is to be blamed for the insanitary conditions and water-borne diseases. In the same way, a decreasing trend of the riparian (buffer) zone of water bodies (Sisa stream) was reported due to prolonged dry season, unpredictable rainfall and increased human population, and over exploitation of land resources. This finding is consistent with Quagrainie's (2011) claim of increasing depletion of nature reserves of river bodies in Kumasi. Although Quagrainie (2011) accused poor urban planning and unplanned urban growth as causes of destruction of nature reserves, findings from this research indicate that the communities perceive climate change as the cause, due to prolonged dry season.

4.2.2. Erratic and low rainfall

With Kumasi's geographical location in the wet equatorial climatic zone of Ghana, the city experiences double maxima rainfall patterns with major rainy season occurring between March and July and the minor rainfall season occurring between September and November each year. A noticeable variation in rainfall patterns over the last 40 years has occurred in Kumasi (see Table 3). The average total annual rainfall in Kumasi during the last 40 years from 1970 to 2013 was only

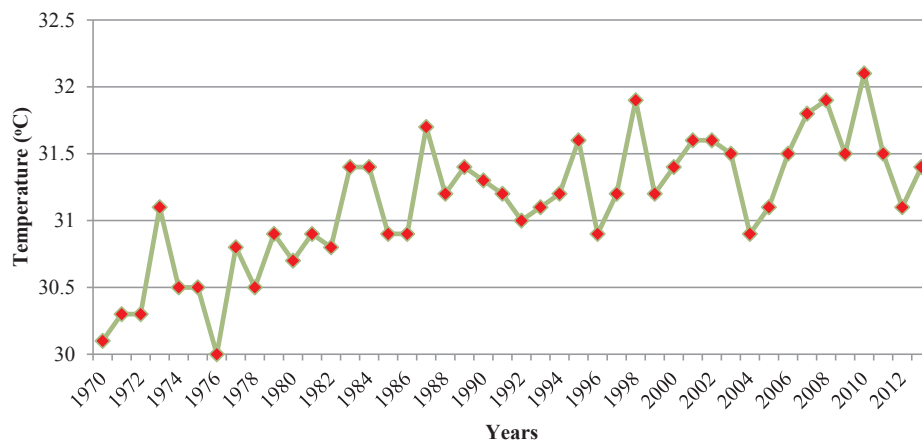


Fig. 2. Mean Maximum Temperature of Kumasi (1970–2013).
Source: GMet (2016).

1011 mm which is low in comparison to the national annual average rainfall of 1187 mm. As presented in Table 3, the highest total rainfall (1668.3 mm) occurred in 2002 while 1984 recorded the lowest total rainfall of 914.4 mm.

The rainfall pattern was analysed with reference to the communities using both meteorological data and household respondents' observation during the household survey. A trend was observed in a highly variable rainfall pattern in minor rainy season remarkably in September to November, affecting the planning of the economic activities of residents in the communities. As discussed in Section 4.1, majority of respondents across the three communities are engaged in the commerce sector, and involved in petty trading and hawking, which are considerably influenced by unpredicted precipitation, because such activities often occur in the open. Additionally, mean dry season rainfall in December to February was found to be very erratic and highly variable between 1970 and 2013.

The household respondents across the three communities (75%) reported that flood cases were common and widespread during the major rainy season (March–July) due to extended and extreme nature of rainfall.

...It was around the late 1990s that we began to see visible variations in the rainfall pattern ... the period we expect the rain, it doesn't fall, but when it finally does, it is often for a long period and results in flood events... Sisaakyi 14, February 2017.

Other respondents (21%) indicated cases of potential flash floods

between December and February because of, among others, encroachment on riparian zones of streams and indiscriminate dumping of solid wastes into streams and drains. Thus, in reality, these floods may not be related to climate change but 'normal rainfalls' in which human activities have degraded or blocked natural waterways leading to flood events even at the least rainfall. These findings were confirmed by the institutional officials (e.g., NADMO, KMA and EPA) who, despite admitting the natural influence of the variations in the rainfall pattern on flood events, emphasised that poor attitude of local residents, in terms of dumping of solid wastes, and occupation in unbuildable landscape in the city as major contributing factors to flood events. One institutional official commented that:

... It is true that changes in rainfall patterns have contributed to some flooding in the city. However, I think the problem we have in this city is that many residents especially those living in communities such as Moshie Zongo, Asawase, Aboabo, Sisaakyi etc. don't pay attention to their environment; they dump garbage indiscriminately on streets, drains and even into water bodies. In such situations, what else do you expect than flooding? ... EPA, January 2016.

This finding supports those of Owusu-Ansah (2015) who found that the impervious surfaces resulting from the removal of wetlands, riparian lands and urban vegetation, in addition to deposits of sediments and domestic wastes into streams and drains, have combined to contribute to flooding in surrounding built up areas particularly areas on

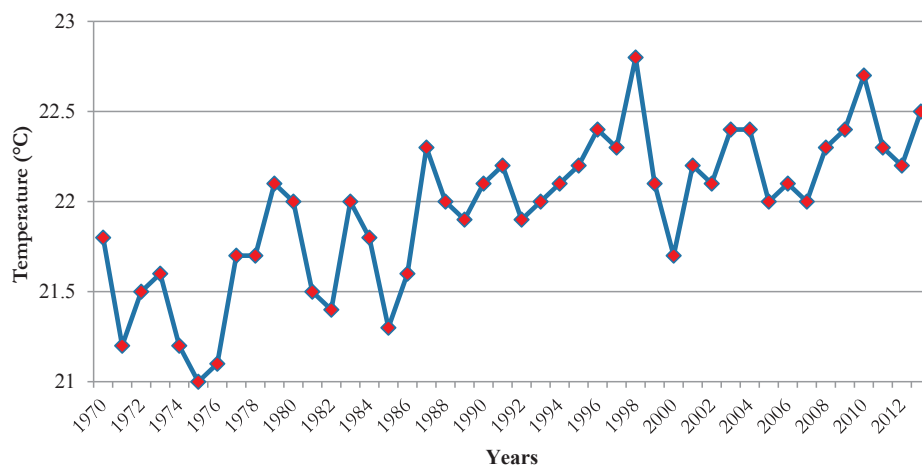


Fig. 3. Mean Minimum Temperature of Kumasi (1970–2013).
Source: GMet (2016).

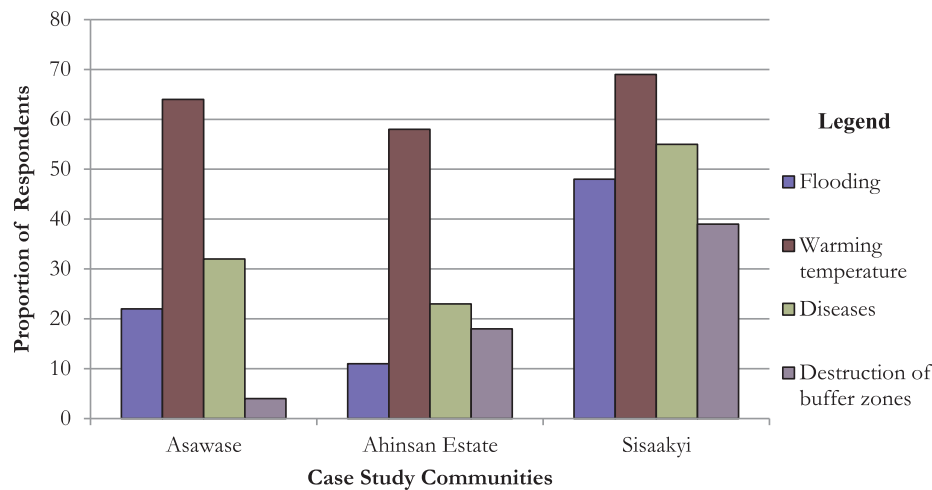


Fig. 4. Respondents Perceptions of Climate Change Impacts.
Source: Field Survey, January–February 2016.

Table 3

Pattern of rainfall (mm) in Kumasi (1970–2013).
Source: GMet (2016).

Year	Total Rainfall (Jan-Dec)	Total Dry Season Rainfall (Dec-Feb)	Total Major Rainy Season Rainfall (March-July)	Total Minor Rainy Season Rainfall (Sept-Nov)
1970	1322.8	51.8	785.3	442.4
1972	1630.9	190.3	888	525
1974	1411.7	61.3	893.4	306.3
1976	1474.1	89.4	123.7	433.2
1978	982.8	176.8	512.9	75.7
1980	1538.2	127.6	633.2	355.9
1982	1191.2	143.6	460.8	210.8
1984	914.4	22.2	804.5	398
1986	1232.6	132.1	734.2	297.8
1988	1520.4	88.9	1056	360.5
1990	1219.2	184.8	573.6	433.5
1992	1063.5	16.2	589.3	427.6
1994	1111.1	7.3	156.1	370.3
1996	1040.9	135.8	638.4	157.1
1998	1092.2	110.1	731.8	174.7
2000	1488.5	69.6	1011.8	341.8
2002	1668.3	14.6	1090.1	487.8
2004	1415.3	173.1	607.8	519.4
2006	1159.8	213.2	579.1	302.3
2008	1452.0	108.5	886.8	264.1
2010	1197.5	105.7	165.9	430.8
2012	1521.4	183.6	955.7	378.7
2013	1597.8	96.7	736	510.6

lower terrains.

4.3. Unplanned urban growth challenges in Kumasi

Urban studies literature on Ghana and Kumasi is replete with unplanned urban growth challenges including slums, (e.g., Amoako & Cobbinah, 2011), flooding (Owusu-Ansah, 2015), unplanned and haphazard development (e.g., Amoateng et al., 2013), urban sprawl (e.g., Cobbinah & Amoako, 2012) and open spaces destruction (Quagraine, 2011). These studies portray the extent of deterioration in Kumasi's urban landscape influenced by both natural and anthropogenic factors. However, in understanding issues of urban resilience, it is imperative to evaluate local communities' perspectives on what they consider unplanned urban growth challenges. Findings from the household survey identify three major challenges: poor sanitation, destruction of ecologically sensitive areas, and growing unplanned informal settlements.

First, survey results indicate poor sanitation as a major challenge;

however the nature and extent vary considerably from one community to another. For example, over 70% of the Asawase respondents reported limited public toilet facilities:

... All residents living in this part of the community [over 100 people] have only one public toilet. Sometimes, we have to queue for our turn ... Asawase 2, February 2016.

In Sisaakyi, the respondents were more concerned with the indiscriminate dumping of both solid and liquid wastes (see Fig. 5). Over 80% of Sisaakyi respondents reported widespread incidence of indiscriminate dumping in the community, which some believe has contributed to fertile breeding grounds for mosquitoes in the community. In Ahinsan Estate, however, many respondents (45%) were particularly worried with choked gutters. Infrequent desilting of the gutters by sub-metropolitan council coupled with activities of some nonchalant residents discharging their liquid waste into broken gutters which often spill onto roads was mentioned by the respondents as major sanitation challenges.

Second, the problem of destruction of ecologically sensitive areas was mostly reported in Sisaakyi and Ahinsan Estate communities. This situation is understandable as these two communities are traversed by the Sisa stream. In Sisaakyi, the respondents mentioned that the riparian zone of the stream is increasingly depleted because of human occupation which they claim is due to limited habitable land in the area:

... Look at where my house is, it is almost in the water [in the stream], we don't have enough land here, the city authorities don't care about us ... Sisaakyi 15, February 2017.

Although the Sisaakyi respondents are aware of the implications of living in close proximity to the stream in terms of flooding and destruction of the riparian zones, they argue that unless government and city authorities support them, they have nowhere to go but to live in such perilous environment. Interviews with the KMA official however suggest that many of the Sisaakyi residents are occupying unauthorised location unrecognised by the Metropolitan Assembly, a reason why many of them lack basic social amenities such as sanitation facilities. Unfortunately, the KMA seems not to have any plan for the Sisaakyi community as the official did not provide any indication of immediate support or relocation for those living in unauthorised locations in Sisaakyi.

In contrast, Ahinsan Estate respondents (53%) reported that the riparian zone of the Sisa stream is increasingly being depleted due to the activities of Sisaakyi and other upstream communities, and to some extent, Ahinsan Estate residents. According to these respondents (53%),

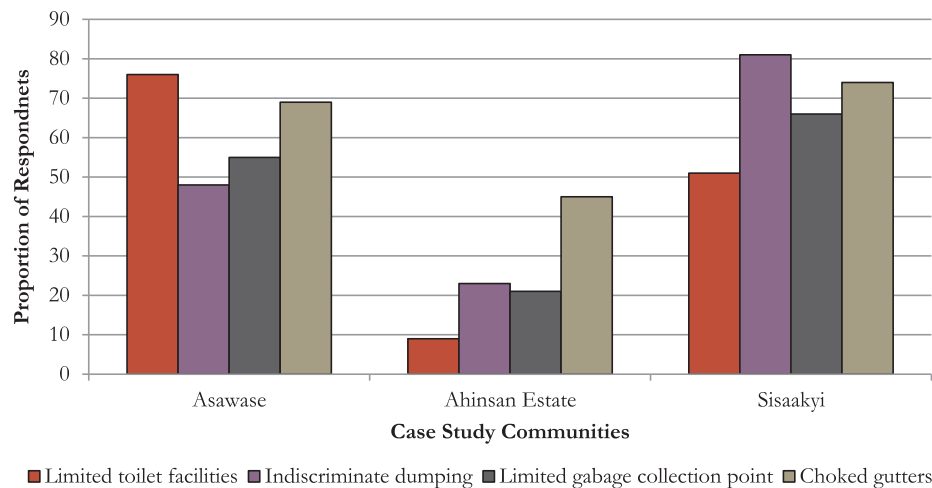


Fig. 5. Sanitation conditions in the case study communities.
Source: Field Survey, January–February 2016.

residents from Sisaakyi and other upstream communities use the Sisa stream as a dumping ground for solid waste. The solid waste pollutes the water and frequently gathers at the banks of the stream, damaging the riparian zone. This situation, according to the EPA official, is severely impacting on the quality of the water body, as the stream has gradually been turned into a dumping gutter. The EPA official however admitted that the institution cannot deal with the problem alone but requires the support of the local communities in terms of reforming their attitudes, and supporting the conservation of the water body.

Third, unplanned informal settlements are common in the Kumasi metropolis. Amoako and Cobbinah (2011) conveniently describe these unplanned informal settlements as slums and include neighbourhoods such as Aboabo, Asawase, Sisaakyi and Moshie Zongo. These neighbourhoods are described as slums because they are largely and officially unplanned, lack basic social services, often exhibit poor housing structures and lack good internal circulation. Across the three communities, the majority of residents in Asawase (78%) and Sisaakyi (81%) admitted that their communities are slums based on the above conditions. In Asawase, the respondents mentioned that many residents are migrants who are trying to make ends meet, and that they are not much concerned about the appropriateness of their housing units. They argue that building a house or renting a decent accommodation in Kumasi is expensive in relation to their income, and that they cannot afford. Although they are aware that their living environment is not appropriate, they are not overly concerned. One Asawase respondent said that:

... I am here to work and support my family back home [Northern Region], I am not here to rent an expensive house ... it is true that conditions in this house and this community are not the best, but I can't complain. If I get money, I will get a better house in my home town [Northern Region] ... Asawase 40, February 2016.

Similar findings were reported in Sisaakyi, where the respondents argue that they are mostly migrants. As discussed in Section 4.1, about 85% of Sisaakyi residents are non-natives emphasising its migratory status. As a result, the majority (67%) of the respondents held an opinion that they are temporary residents, and that it is not a great deal to invest in their housing structure and the community.

Interviews with the institutional officials reveal that the planning-related institutions are aware of the slum conditions in these communities. While the KMA official indicates that efforts have been made over the past years to provide such communities with potable water, toilet facilities and schools, the TCPD official also mentions that some of these communities have been rezoned for regularisation. The TCPD official was however unsure whether the study communities

particularly Asawase and Sisaakyi have been rezoned yet.

4.4. Local understanding of urban resilience in Kumasi

As discussed in Section 2, the urban resilience concept is gaining increasing recognition in urban studies. While generally there seems to be a consensus on the importance of the concept in building adaptable societies in the face of changing climate and unplanned urban growth challenges, it remains to be demonstrated whether local communities and institutions are aware of the relevance of urban resilience. This section presents an analysis of the local understanding and interpretation of urban resilience concept and locally initiated efforts towards urban resilience.

4.4.1. Understanding the concept of urban resilience: institutional perspectives

The established urban resilience ideology, emphasising sustainable development and effective management over the traditional adhoc reactive approaches to urban planning in Africa has resulted in the recognition of urban resilience as a new planning agenda, due to its basic principles of building adaptable and enduring urban environments. This characteristic of the urban resilience concept is based on the nine key tenets or principles developed by UNISDR (2013); its potential to: engage multiple stakeholders in the planning process; incorporate risk assessment; make safe land available for urban development; provide public space for streets and infrastructure; upgrade informal settlements; install risk-reducing infrastructure; assess urban development contribution to improving lives; develop good information on risks; and protect ecosystems (see Section 2). Using these nine tenets as a framework for understanding urban resilience in Kumasi, there appears to be a limited understanding of the concept among urban planning-related institutions. Out of the six urban planning-related institutions interviewed, only two (NADMO and EPA) had knowledge of the concept of urban resilience. The NADMO official asserted that:

... In Kumasi here, many of the institutions that are supposed to create the environment for building resilience of communities and residents, don't even know what resilience is, let alone understand what goes into it ... NADMO, February 2016.

To accurately reflect the institutions' perspective on urban resilience, the meaning of the concept was explained to the institutions in terms of its tenets. The institutional officials were further asked to express their understanding of urban resilience in relation to their institutions' activities. Although the interview data suggest a variation in the meaning of urban resilience, all institutional officials consistently

mentioned and discussed incorporating risk assessment and information sharing as an overarching theme of urban resilience. Some institutional officials explained that:

... the concept of urban resilience can be explained as the process of safeguarding communities, people and their livelihoods through the provision and maintenance of quality and reliable road networks ... Department of Urban Roads, January 2016.

... Our understanding of urban resilience is about equipping people with the infrastructure they need to combat challenges such as floods, fires and other natural disasters ... KMA, January 2016.

Other institutional interviewees (TCPD and DUR) mentioned land development and the education of developers on urban land development to avoid locating in areas vulnerable to disasters. As pointed out by the TCPD official, the whole purpose of urban planning in Kumasi is about achieving resilience and sustainable development to reduce risk of natural and anthropogenic disasters:

... Urban resilience is all about disaster management and prevention. Disasters, whether natural or man-made, occur on land. This highlights the importance of land development in avoiding disasters and achieving resilience ... In this case, if developers are fully educated by us [TCPD] and other stakeholders like the media on the importance of land development, then naturally we will achieve resilience, is that not the case? ... TCPD, January 2016.

Other attempts to understand and describe urban resilience relate to information sharing among stakeholders and protecting ecosystems to allow proper drainage and avoid environmental erosion. Institutional interviews show that urban resilience involves information sharing between urban planning institutions, developers and local community residents. The NADMO and EPA officials explained that urban resilience encourages information sharing which is critical in protecting ecologically sensitive areas and resources in Kumasi:

... It is good you are putting an institutional interpretation to urban resilience. To us at NADMO, urban resilience is got to do more with preparation ... It relates to the capacity that a city or community and its individuals have developed in their culture to maintain certain structures and functions despite major disturbances. This obviously includes the capacity to return to a stable equilibrium after that disturbance ... NADMO February 2015.

Analysis of the institutional interviews shows that while there is some level of understanding of the concept from the institutions, only six out of the nine tenets of the concept (incorporating risk assessment, making safe land available for urban development, assessing urban development contribution to local residents, developing good information sharing, and protecting ecosystems) were evident in the institution's interpretations of urban resilience (see Fig. 6). Although

some institutional officials (NADMO, EPA and TCPD) are aware of, and recognised the need for risk assessment in terms of considering exposure, vulnerability and hazards in urban settlements development and services provision, their interpretations of urban resilience do not emphasise installing risk-reducing infrastructure.

These interpretations were further compared with urban planning-related documents (e.g., NADMO policy documents, KMA development plans) on Kumasi. Findings indicate that, aside the National Climate Change Policy 2013 which provides a broad overview of the impacts of climate change, and has one of its five policy themes and strategic focus on disaster preparedness and response, there are no known urban resilience policies in Kumasi. Besides, the National Climate Change Policy 2013, as the name suggests, overly focused on climate change without adequately considering other variables (e.g., unplanned urban growth) that interact to shape the future of urban Ghana. Although the interpretations of urban resilience based on the nine tenets outlined above appear to be central to National Climate Change Policy 2013, and the NADMO, EPA and KMA policy documents (e.g., KMA 'Medium-term Development Plan (2010–2013)', EPA's 'Climate Change and Ghanaian Economy (2007) report', and the NADMO 'National Climate Change Adaptation Strategy 2012' and 'the Hyogo Framework for Action 2005–2015'), discussions with the institutions in Kumasi show they have a limited understanding of the comprehensiveness of the concept and its application. As a consequence, the NADMO official indicated that planning activities in Kumasi branded as resilient are not geared towards achieving resiliency, because they do not accurately reflect the foundational principles of urban resilience.

Examination of planning and resilience policies provided by NADMO, EPA and KMA further revealed that the various resilient tenets (i.e., risk assessment, multiple stakeholder engagement, urban development, information sharing, ecosystem protection and availability of safe lands for habitation) highlighted in those documents appear to have been influenced by the involvement and participation of international organisations such as UNDP in the preparation of these documents, rather than by a locally driven understanding of resilience. As a result, there appears to be a disconnect between urban resilience tenets proposed in these documents, and what is applied in reality. Additionally, a review of these documents shows that their implementation has been marred with challenges, because international organisations supported their preparation whereas local institutions with limited understanding have implemented them.

4.4.2. Local communities' perspectives and experiences of urban resilience

Findings from the household survey indicate that the idea of urban resilience was foreign to many local residents. As a result, the concept of urban resilience was explained to the respondents based on the foundational tenets, and were asked to indicate which of the tenets are visible or occurring in their communities, and which ones they consider

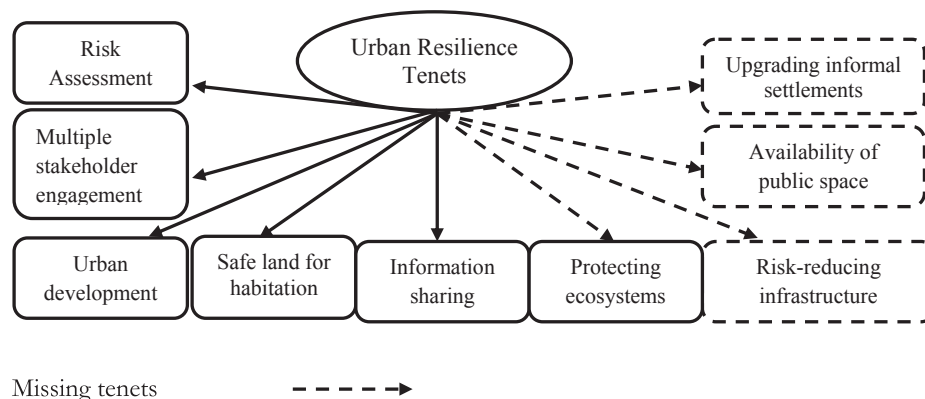


Fig. 6. Urban resilience interpretations in Kumasi – key principles.
Source: Based on Field Survey, January–February 2016.

Table 4
Community Perceptions of Evidence and Application of Resilience (n = 375).
Source: Field Survey January–February 2016.

Tenets of Urban Resilience	Asawase (%)		Ahinsan Estate (%)		Sisaakyi (%)		Overall (%)	
	Evidence	Applicable	Evidence	Applicable	Evidence	Applicable	Evidence	Applicable
1. Stakeholder engagement	13	87	31	95	12	83	18.7	88.3
2. Incorporating risk assessment	0	72	36	77	5	96	13.7	81.7
3. Making safe land available for urban development	0	94	3	88	0	98	1.0	93.3
4. Provision of public space	0	92	29	91	0	94	9.7	92.3
5. Upgrading informal settlements	0	98	0	58	0	92	0	82.7
6. Installing risk-reducing infrastructure	0	81	30	87	0	96	10.0	88
7. Urban development contribution to improve lives	9	94	41	90	15	97	21.7	93.7
8. Good information sharing system	14	98	52	94	21	76	29.0	89.3
9. Protecting ecosystems	0	53	2	81	0	44	0.7	59.3

necessary in their communities. Based on the nine foundational tenets, findings show an overwhelmingly limited appreciation of the evidences of urban resilience in the communities. As present in Table 4, although majority of the respondents across the communities consider all the nine tenets to be applicable and necessary in their communities, less than 30% of the respondents reported evidence of the urban resilience occurring in the communities.

Across the three communities, urban resilience is more evident in Ahinsan Estate compared to Sisaakyi and Asawase communities. For example, while about 52% and 41% of Ahinsan Estate respondents reported evidence of urban resilience tenets number 8 (i.e. information sharing) and number 7 (i.e. urban development that contribute to improving lives) respectively, only 14% and 9% of Asawase respondents reported such evidences (see Table 4). Despite the relatively reasonable cases of urban resilience in relation to the foundational tenets in Ahinsan Estate, Table 4 shows that household responses for 8 out of the 9 tenets were less than 50%. The situation was however worse in Sisaakyi and Asawase communities where 5 out of the 9 tenets were reported not to be occurring.

The foundational tenets that receive low responses across the three communities include upgrading of informal settlements (0%), protecting ecosystems (0.7%), making safe land available for urban development (1%), and provision of public space (9.7%). While the low response rate of evidence of urban resilience for the aforementioned tenets may not be a surprise given the status of communities like Sisaakyi and Asawase as slum, the finding is particularly worrying in this time and age when climate change is occurring and unplanned urban growth remains uncontrollable.

Interestingly, findings from the survey indicate that over 60% of respondents across the three communities acknowledged the need for the application of all nine urban resilience tenets. Mentioning the many challenges confronting the communities, particularly Sisaakyi and Asawase communities, including poor sanitation, flood events, poor housing structure, encroachment on riparian zone of water bodies, congestion, and lack of basic social amenities, the respondents believe that effective application of the urban resilience tenets would improve their living conditions and facilitate their socio-economic activities:

... Our number one problem is sanitation and because of that there are mosquitoes everywhere ... so if we can have a policy that will help upgrade our community from what it is now to one where we participate in decision making, and there is safe land for development, I think many of us will be better off... Asawase 3, February 2016.

The above quote is representative of the community responses regarding the need for the application of the urban resilience tenets. The quote seems to indicate some level of community support for urban resilience, as they perceive the tenets of resilience as the panacea to their problems, both anthropogenic and natural.

4.5. Policy implications towards urban resilience in Kumasi

There is evidence of climate change and unplanned urban growth occurring in Kumasi. The findings show that the application of the urban resilience concept has the potential to contribute to adaptable urban environment in the face of these threats. However, those potential contributions of urban resilience are often limited by lack of locally driven policy direction, and unfavourable local conditions at the institutional and community levels. This is because the application of the urban resilience tenets cannot deliver adaptable urban environment when they are not supported by effective policies (Cobbinah & Darkwah, 2016a), and do not involve the local communities (UNISDR, 2013). Given the widespread unplanned urban growth challenges in Kumasi, an assessment of current efforts towards improved, concerted and comprehensive policy or programme that makes appreciable attempts towards effectuating the tenets of urban resilience concept is tenable. This also falls within the global efforts towards achieving the sustainable development goals, particularly goal 11 (UN, 2016). As outlined in the tenets of urban resilience, the process of policy formulation should involve regular consultation of multiple stakeholders particularly government institutions, NGOs and local communities to ensure that needs of the various actors are addressed and reflected.

The literature on urban resilience suggests that unlocking socio-economic and environmental opportunities for urban residents is central to urban resilience (Chelleri & Olazabal, 2012; UNISDR, 2013). However, the lack of focus by planning related agencies on delivering benefits to urban residents, particularly those living in most vulnerable communities has limited the contribution of urban resilience to improving and achieving sustainable and adaptable urban environment in Kumasi. The communities reported limited evidence of actualisation of the tenets of the urban resilience despite the availability of locally developed initiatives by the urban planning-related institutions.

This study argues that urban resilience policy and programme in Kumasi and Ghana in general should be supported by strong political will from both city and national governments, not only incorporating public awareness, but also ensuring its successful execution. Developing a more supportive policy and programme is fundamental to ensuring that the potential of the urban resilience concept regarding creating sustainable and adaptable urban environment is realised (Liao, 2012; Serre & Barroca, 2013) and further contribute to the global efforts of creating resilient, inclusive and safe communities, as stated in the sustainable development goals (UN, 2016). Urban planning institutions, working cooperatively with the governments, private sector, donor agencies, local communities and NGOs, should both develop local community oriented urban resilience policies, and ensure that they are fully implemented. This situation would ensure that local communities, disadvantaged and poor locations, not only participate in the process of urban development, but receive the benefits which may result from the application of the urban resilience tenets.

Actualisation of urban resilience tenets is largely based on strong

institutional framework. But, as the study findings indicate, efforts towards urban resilience in Kumasi are driven by the activities of individual institutions without any coordinated or collaborative effort amongst the urban planning-related institutions. This, coupled with limited institutional understanding, makes local efforts towards urban resilience ineffective and largely infantile. Considering that research on urban resilience advocates for strong collaboration amongst stakeholders (see Campanella, 2006; Lu & Stead, 2013), building strong collaboration and coordination amongst local urban planning-related institutions is imperative in realising the ideals of urban resilience in Kumasi. Although there is a general preoccupation with independent driven efforts towards urban resilience in Kumasi amongst the institutions, there is also the reality that uncoordinated efforts frequently provide limited successes (see Chelleri & Olazabal, 2012).

Among the local communities, the study findings show that residents have limited knowledge of the urban resilience concept. Policy initiative should focus on empowering local communities, especially those living in vulnerable communities. Promoting the participation of poor communities in policy decision making to ensure that their priorities are reflected in urban resilience efforts remains a key tenet of urban resilience (UNISDR, 2013). This is likely to increase public awareness on urban growth and climate change challenges, and the how to effectively manage the impacts (Beatley & Newman, 2013).

5. Conclusion

This research has evaluated the concept of urban resilience within the context of climate change and urban growth, as well as its outcomes on supporting sustainable urban environment in Kumasi. The key findings from this study are that while climate change is occurring with negative consequences on vulnerable communities, unplanned urban growth is compounding the suffering of the local residents. Findings show a gradual warming of temperature in Kumasi, and unpredictable pattern of rainfall. This situation is reported to be generating hardships on the local residents in the communities, as flooding, destruction of natural areas, and emergence of mosquito breeding ground with associated malaria cases have become regular experience of residents. This situation is further compounded by unplanned urban growth resulting in poor sanitation, poor housing conditions and inadequate social services. However, the findings further show that many of the perceived climate change impacts are caused by human behaviour in terms of poor attitudes towards the environment.

Local urban planning-related institutions do not recognise risk-reducing infrastructure, public spaces and slum upgrading as urban resilience tenets, as they focus more on multiple stakeholder engagement, urban development, provision of safe land for habitation, information sharing and risk assessment. The development of urban resilience-focused development plans and policies appears to be influenced by international organisations (e.g., UNDP), who provide financial and technical support. However, local urban planning-related institutions with limited understanding of the concept and funding implement these plans. Thus, despite the availability of urban resilience efforts in Kumasi, most urban residents in the study communities reported limited evidence of actualisation of urban resilience tenets.

Residents of the local communities in Kumasi are willing to embrace and support the implementation of the tenets of urban resilience. This situation suggests that a modest commitment from the government and the urban planning-related institutions towards understanding and implementing the tenets of the urban resilience has the potential to generate positive outcomes in terms of creating sustainable urban environment, which will further contribute to Ghana's efforts towards achieving the sustainable development goals. This research recommends the formulation of urban resilience policy to support the implementation of the concept's tenets. Other recommendations include the integration of public awareness on urban resilience in urban development efforts, and promotion of institutional coordination in

urban resilience initiatives in Kumasi. It is hoped that the implementation of these recommendations would contribute to the creation of sustainable urban environment where the risks of climate change and unplanned urban growth are minimised.

Current narratives on urban resilience are discussed within the contexts of global urbanisation and climate change. For instance, studies on urban resilience have concentrated on developed countries focusing on how to manage urban growth and climate change impacts (Jabareen, 2013; ULI, 2010). In African cities, an attempt to understand and explore the vulnerabilities of cities and residents have been made, yet knowledge on urban resilience is limited (see Poku-Boansi & Cobbinah, 2018). The importance of urban resilience, in terms of community experiences and responses, has not received attention in the literature. Consistent with these general views, this paper argues that the extent of urban resilience in many African cities is rooted in urban residents' experiences and responses to climate change impacts and unplanned urban growth that produce informal urban spaces characterised by challenges such as flooding and destruction of natural areas. These processes have evolved over the years, and have shaped urban residents perception of the relevance of urban resilience. Thus, flood vulnerability in these cities is a product of urban state's policy positions. These changing positions of the urban state have in turn shaped community and household flood responses. As a result, understanding flood vulnerability in cities in the developing world requires a clearer and deeper understanding of how those cities grow and are governed. An important entry point in this direction is a re-examination of the current structure and processes of urban governance, state-community engagements and urban citizenship. This can be done through rethinking the overall urban planning and development processes, urban land management and participatory urban governance and the right to urban citizenship.

References

- Adarkwa, K.K., 2012. The changing face of Ghanaian cities. *Afr. Centre Econ. Finance* 4 (1), 1–29.
- Adger, W.N., 2006. Vulnerability. *Global Environ. Change* 16 (3), 268–281.
- Amoako, C., Cobbinah, P.B., 2011. Slum improvement in the Kumasi metropolis: review of results and approaches. *J. Sustain. Dev. Africa* 13 (8), 150–170.
- Amoateng, P., Cobbinah, P.B., Owusu-Adade, K., 2013. Managing physical development in peri-urban areas of Kumasi, Ghana: a case of Abuakwa. *J. Urban Environ. Eng.* 7 (1).
- Amos-Abanyie, S., 2011. Climate change and housing in Kumasi. In: Adarkwa, K.K. (Ed.), *The Future of the Tree: Towards Growth and Development of Kumasi*. KNUST Printing Press, Kumasi, pp. 195–211.
- Awumbila, M., Owusu, G., Teye, J.K., 2014. Can rural-urban migration into slums reduce poverty? Evidence from Ghana. Working Paper 13.
- Beatley, T., Newman, P., 2013. Biophilic cities are sustainable, resilient cities. *Sustainability* 5, 3328–3345.
- Blakely, E.J. (2007). Urban planning for climate change. Lincoln Institute of Land Policy Working Paper, pp. 1–25.
- Boamah, N.A., Gyimah, C., Nelson, J.K.B., 2012. Challenges to the enforcement of development controls in the Wa municipality. *Habitat Int.* 36 (1), 136–142.
- Bulkeley, H., Schroeder, H., Janda, K., Zhao, J., Armstrong, A., Chu, S.Y., Ghosh, S., 2009. Cities and climate change: the role of institutions, governance and urban planning. *Change* 28, 30.
- Campanella, T.J., 2006. Urban resilience and the recovery of New Orleans. *J. Am. Plann. Assoc.* 72 (2), 141–146.
- Chelleri, L., Olazabal, M., (Eds.), 2012. *Multidisciplinary Perspectives on Urban Resilience: A Workshop Report*. BC3, Basque Centre for Climate Change.
- Cobbinah, P.B., 2017. Managing cities and resolving conflicts: Local people's attitudes towards urban planning in Kumasi, Ghana. *Land Use Policy* 68, 222–231. <http://dx.doi.org/10.1016/j.landusepol.2017.07.050>.
- Cobbinah, P.B., Aboagye, H.N., 2017. A Ghanaian twist to urban sprawl. *Land Use Policy* 61, 231–241.
- Cobbinah, P.B., Amoako, C., 2012. Urban Sprawl and the Loss of Peri-Urban Land in Kumasi, Ghana. *Int. J. Soc. Human Sci.* 6, 388–397.
- Cobbinah, P.B., Anane, G.K., 2016. Climate change adaptation in rural Ghana: indigenous perceptions and strategies. *Climate Dev.* 8 (2), 169–178.
- Cobbinah, P.B., Erdiaw-Kwasie, M.O., Amoateng, P., 2015. Africa's urbanisation: implications for sustainable development. *Cities* 47, 62–72.
- Cobbinah, P.B., Darkwah, R.M., 2016a. African urbanism: the geography of urban greenery. *Urban Forum* 27 (2), 149–165.
- Cobbinah, P.B., Darkwah, R.M., 2016b. Urban planning and politics in Ghana. *GeoJournal* 1–17. <http://dx.doi.org/10.1007/s10708-016-9750-y>.

- Cobbinah, P.B., Korah, P.I., 2016. Religion gnaws urban planning: the geography of places of worship in Kumasi, Ghana. *Int. J. Urban Sustain. Develop.* 8 (2), 93–109.
- Fuseini, I., Kemp, J., 2015. A review of spatial planning in Ghana's socio-economic development trajectory: a sustainable development perspective. *Land Use Policy* 47, 309–320.
- Gocking, R., 2005. *The History of Ghana*. Greenwood Publishing Group, Westport, CT USA.
- GSS, 2014. 2010 population and housing census: district analytical report, Kumasi metropolitan area. Accra: GSS. Retrieved 14/09/2017 from: < http://www.statsghana.gov.gh/docfiles/2010_District_Report/Ashanti/KMA.pdf > .
- IPCC, 2007. Climate change 2007: appendix to synthesis report. In: Baede, A.P.M., van der Linden, P., Verbruggen, A. (Eds.), *Climate Change 2007: Synthesis Report*. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. IPCC, Geneva, pp. 76–89.
- IPCC, 2013. *Climate Change 2013: The Physical Sciences Basis*. Cambridge University Press, IPCC, Cambridge.
- Jabareen, Y., 2013. Planning the resilient city: concepts and strategies for coping with climate change and environmental risk. *Cities* 31, 220–229.
- Liao, K., 2012. A theory on urban resilience to floods—a basis for alternative planning practices. *Ecol. Soc.* 17 (4), 48.
- Lu, P., Stead, D., 2013. Understanding the notion of resilience in spatial planning: a case study of Rotterdam, The Netherlands. *Cities* 35, 200–212. <http://dx.doi.org/10.1016/j.cities.2013.06.001>.
- Mosha, A.C., 2011. The effects of climate change on urban human settlements in Africa. In: Yuen, B., Kumssa, A. (Eds.), *Climate Change and Sustainable Urban Development in Africa and Asia*. Springer Science, London, pp. 69–100.
- Obeng-Odoom, F., 2010. 'Abnormal' urbanisation in Africa: a dissenting view. *Afr. Geogr. Rev.* 29 (2), 13–40.
- Ogato, G.S., Abebe, K., Bantider, A., Geneletti, D., 2017. Towards mainstreaming climate change adaptation into urban land use planning and management: the case of Ambo Town, Ethiopia. In: *Climate Change Adaptation in Africa*. Springer International Publishing, pp. 61–85.
- Ove Arup & Partners International Limited, 2014. *City resilience index: City Resilience Framework*. Report prepared in April for Rockefeller Foundation.
- Owusu-Ansah, J.K., 2015. The influences of land use and sanitation infrastructure on flooding in Kumasi, Ghana. *GeoJournal* 1–16.
- Owusu, G., Oteng-Ababio, M., 2015. Moving unruly contemporary urbanism. Toward sustainable urban development in Ghana by 2030. *Am. Behav. Sci.* 59 (3), 311–327.
- Pickett, S.T.A., Cadenasso, M.L., Grove, J.M., 2004. Resilient cities: meaning, models, and metaphor for integrating the ecological, socio-economic, and planning realms. *Landscape and Urban Planning* 69, 369–384.
- Poku-Boansi, M., Cobbinah, P.B., 2018. Are we planning for resilient cities in Ghana? An analysis of policy and planners' perspectives. *Cities* 72, 252–260.
- Potts, D., 2009. The slowing of sub-Saharan Africa's urbanisation: evidence and implications for urban livelihoods. *Environ. Urban.* 21, 253–259.
- Potts, D., 2012. *Whatever happened to Africa's rapid urbanisation? Counterpoint Series*. London, England: Africa Research Institute. Retrieved from <http://africaresearchinstitute.org/newsite/wpcontent/uploads/2013/03/Whatever-happened-to-Africas-rapidurbanisation.pdf>.
- Planning Institute Australia, 2016. *Resilience*. New Planner, vol. 106, pp. 1–32. Retrieved 16th June 2017 from: < <https://www.planning.org.au/documents/item/7355> > .
- Prasad, N., Ranghieri, F., Shah, F., Trohanis, Z., Kessler, E., Sinha, R., 2009. *Climate Resilient Cities: A Primer on Reducing Vulnerabilities to Disasters*. World Bank, Washington, DC.
- Quagraine, V.K., 2011. Urban landscape depletion in the Kumasi metropolis. In: Adarkwa (Ed.), *Future of the tree towards growth and development of Kumasi*. University Printing Press KNUST, Kumasi, pp. 212–233.
- Quarcoopome, S.S., 1993. A history of the urban development of Accra: 1877–1957. *Res. Rev.* 9 (1–2), 20–32.
- Schmitt, P., 2013. Managing urban change in five European urban agglomerations: key policy documents and institutional frameworks. In: Eraydin, A., Tasan-Kok, T. (Eds.), *Resilience Thinking in Urban Planning*. Springer, Netherlands, pp. 109–130.
- Seeliger, L., Turok, I., 2013. Towards sustainable cities: extending resilience with insights from Vulnerability and Transition Theory. *Sustainability* 5, 2108–2128.
- SEI, 2008. *Climate change and adaptation in African agriculture*. Report prepared in March for Rockefeller Foundation.
- Serre, D., Barroca, B., 2013. Preface: "Natural hazard resilient cities". *Nat. Hazards Earth Syst. Sci.* 13 (2675–2678), 2013.
- Tyler, S., Moench, M., 2012. A framework for urban climate resilience. *Climate Dev.* 4 (4), 311–326.
- ULI, 2010. *Resilient Cities: Surviving in a New World*. London, UK.
- UN, 2008. *Agriculture and Rural Development-Gender in Agriculture Sourcebook*. The International Bank for Reconstruction and Development/The World Bank, Washington, DC.
- UN, 2016. *Sustainable Development Goals, 17 Goals to Transform Our World: Goal 11: Make Cities Inclusive, Safe, Resilient and Sustainable*. (Retrieved January 2, 2017, from). <http://www.un.org/sustainabledevelopment/cities/>.
- UNDESA/PD, 2012. *World urbanisation prospects: The 2011 revision*. New York: United Nations.
- UN-Habitat, 2011. *Cities and Climate Change: Global Report on Human Settlements 2011*. UN-Habitat, Nairobi.
- UN-Habitat, 2014. *State of African Cities 2014: Re-imagining Sustainable Urban Transitions*. UN-Habitat, Nairobi, Kenya.
- UNEP and UNDP, 2010. *National Climate Change Adaptation Strategy*. Climate Change and Development – Adapting by Reducing Vulnerability. A joint UNEP/UNDP programme for Sub-Saharan Africa funded by the Danish Ministry of Foreign Affairs. http://www.unep-alm.org/sites/default/files/downloads/ghana_national_climate_change_adaptation_strategy_nccas.pdf (Retrieved 17/08/2015).
- UNISDR, 2013. *Making cities resilient: Summary for policy makers*. A global snapshot of how local governments reduce disaster risk – April 2013.
- Walisser, B., Mueller, B., McLean, C., 2005. *The resilient city*. Prepared for the World Urban Forum 2006 by the Vancouver Working Group. Canada: Ministry of Community, Aboriginal and Women's Services, Government of British Columbia.